Final Report for the Joint Fire Sciences Program

Project Number 00-2-23

Entitled:

Managing Fuels and Forest Structure in the Southern Boreal Forest on Minnesota's National Forests.

September 9, 2004

Prepared by:
Daniel W. Gilmore
dilmore@umn.edu
Department of Forest Resources
University of Minnesota
1861 Highway 169 East
Grand Rapids, MN
55744-3396

Investigators and Cooperators:
Marty Christensen, & John C. Zasada
USDA Forest Service
Forest Sciences Laboratory
1831 Highway 169 East
Grand Rapids, MN 55744, and

Kamal J.K Gandhi, & Steven J. Seybold
USDA Forest Service
Chemical Ecology of Forest Insects
Pacific Southwest Research Station
720 Olive Drive, Suite D
Davis, California 95616

Executive Summary

Within an hours time on July 4, 1999, the character of about 400,000 acres of the BWCAW and surrounding area was changed "forever" by a severe and unprecedented wind storm. In the Gunflint Corridor and Little East Creek areas prescribed burning, salvage logging, and piling and burning have been used to alter the quantity and structure of living and dead materials (entire stands were blown down in many areas creating huge concentrations of fuels) resulting from the storm with the goal of reducing fire hazard. We established approximately 448 permanent plots and 1,700 subplots at 32 selected sites in the Superior National Forest. Monitoring the results of these treatments provided an excellent demonstration of options for managing similar future disturbance on public and private lands.

We have several important findings:

- Tree in lower canopy positions were primarily conifers and generally suffered less damage than overstory deciduous species. This suggests that in the absence of further disturbance, the landscape would have a greater component of conifer species.
- Fuel reduction treatments eliminated the conifer understory that survived the storm in most instances. Thus, fuel reduction treatments have the potential to alter successional pathways and create a landscape with a greater component of deciduous tree species.
- In the shrub layer, however, no difference in species diversity, species turnover, or composition were detected after three years.
- Salvage treatments affected bark beetle populations. In general, fewer bark beetles overall were detected in areas where trees were salvaged.
- In unsalvaged areas, bark beetles normally associated with dead trees were found to attack and kill living trees. Note, however, that these living trees were experiencing severe stress in the years following the wind storm.

Project Objectives:

1. Demonstrate the effectiveness of alternative treatments for managing the quantity and distribution of fuels, and forest structure in these sub-boreal ecosystems. Our intent was to provide interested professionals and the public with quantified pre-treatment descriptions of fuels and forest structure, alternative treatment descriptions, and site conditions for which these different treatments seem most appropriate.
2. Monitor and quantitatively describe the short-term effects of these fuels treatments on selected aspects of succession, tree/plant composition and structure, insect populations, and fungal associations. Using these data and other currently available information and models, we will describe the most likely scenarios of fuel dynamics and pathways of forest succession for the different forest structures created in these demonstration areas. We will provide prescriptions for various types of sites and disturbances and the most likely forest ecosystems in the short and long run to interested parties.

We were able to achieve the project objectives without modification in the following ways. For Objective 1, we have published a USDA Forest Service Research Note (Gilmore et al. 2003). In

addition, we have presented several posters to various meetings including the Forest Health Monitoring meeting for the past three years (**http://www.na.fs.fed.us/spfo/fhm/posters/index.htm**). For Objective 2, JFSP funds have been used to partially support two graduate students at the University of Minnesota. Hugh P. Johnson completed his masters thesis this past summer and Kamal J.K. Gandhi will complete here Ph.D. in the spring of 2005.

In addition we have supplemented JFSP monies with several other grants. Funding from this project has contributed to the writing of nine publications, including a paper in the Society of American Foresters Proceedings, a USDA Forest Service Research Note, and several informational notes in newsletters. Five presentations have been partially supported from project funds including a presentation to the Minnesota Forest Resource Council. Project funds have also partially supported travel to present 11 posters.

Citations for these presentations are provided below. Those marked with an asterisk are included on the enclosed CD. Note that the posters were often presented at multiple meetings.

Project funds have also partially supported collaboration with Dr. Terry Daniel of the University of Arizona and Dr. Brian Orland of The Pennsylvania State University. They have constructed a website to provide a visualization of fuel loadings in various forest types in North America. Their website is: **http://www.imlab.psu.edu/gunflint/**

Publications

2001

*Anderson, P.J., D.W. Gilmore, L.S. Yount and J.C. Zasada. 2001. Effects of blow-down and salvage/fuel reduction activity on forest succession pathways in northern Minnesota. Poster Abstract. Pp. 496-500 In *Proceedings of the Society of American Foresters National Convention*, Washington, DC

Gandhi, K. J. K. 2001. Responses of sub-boreal beetles to a severe windstorm event to silvicultural activities and to prescribed fire in northeastern Minnesota. *Minnesota Department of Natural Resources, Forest Insect and Disease Newsletter*, June Issue

Gandhi, K.J.K, P.J. Anderson, D.W. Gilmore, R.A. Haack, W.J. Mattson, J.C. Zasada, and S.J. Seybold. 2001. Responses of sub-boreal beetles to a severe wind disturbance event and silvicultural activities in northeastern Minnesota. In Volney, W.J.A., Spence, J.R., Lefebvre, E.M., Editors. The North American Forest Insect Work Conference Proceedings. May 14-18, 2001. Edmonton, Alberta. Nat. Resour. Can., Can. For. Serv., North. For. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-381.

Gilmore, D.W., P.J. Anderson, D. Kastendick, L.S. Yount and J.C. Zasada. 2001. Pre- and post-blow down stand structure of two cover types in northern Minnesota. Poster Abstract p. 116 In Yount, L.S., Editor. Third North American Forest Ecology Workshop Program, Issues of Scale – From Theory to Practice. June 24-27, 2001, Duluth, Minnesota

Gilmore, D.W., and J.C. Zasada. 2001. Silviculture research needs and issues. Pp. 15-18. *In*: Mattson, W.J. and D.S. Shriner (editors) Northern Minnesota Independence Day Storm: A Research Needs Assessment. USDA Forest Service General Technical Report NC-216.

Warren, J., Gandhi, K.J.K., Gilmore, D., Seybold, S.J., and Zasada, J. 2001. Research projects initiated in the blowdown: Vegetative and insect monitoring along the Gunflint Trail. *Minnesota Extension Service, Forest Tree Notes* 1 (2): 4-5.

2002

Gandhi, K.J.K., Gilmore, D.W., Seybold, S.J., and Zasada, J.C. 2002. Vegetation and insect monitoring along the Gunflint Trail. *Minnesota Extension Service, Forest Tree Notes* 3(1): 1-2.

*Gilmore, D.W., S.J. Seybold, J.C. Zasada, P.J. Anderson, D.N. Kastendick, K.J.K. Gandhi, and H.P. Johnson. 2002. Cumulative effects of a severe windstorm and subsequent silvicultural treatments on plant and arthropod diversity in the Gunflint Corridor of the Superior National Forest in northern Minnesota: Project Design. Pp 364-379 *In* Proceedings Society of American Foresters 2001 National Convention, Denver, Colorado. SAF Publication 02-01. Bethesda, MD. 469 p.

2003

*Gilmore, D.W., D.N. Kastendick, J.C. Zasada, and P.J. Anderson. 2003. Alternative fuel reduction treatments in the Gunflint Corridor of the Superior National Forest: Second year results and sampling recommendations. USDA Forest Service Research Note NC-381. 8 p.

Presentations

2000

Gilmore, D.W. and J.C. Zasada. 2000. Silviculture Issues: Monitoring the effects of blow-down and salvage/fuel reduction activity on forest succession pathways in northern Minnesota. Presented to the Minnesota Forest Resources Council April Field Meeting at the USDA Forest Service Gunflint Guard Station.

Gilmore, D.W., J.C. Zasada and P.J. Anderson. 2000. Monitoring effects of blow-down and salvage/fuel reduction activity on forest succession pathways in the Gunflint Corridor Area, Superior National Forest: Project design and preliminary data. Presented to: Northern Minnesota Storm Recovery Research Needs Planning Workshop; March 14-16, 2000; Earle Brown Conference Center, University of Minnesota – St Paul Campus

2001

Gilmore, D.W., L.S. Yount, and M. Theimer. 2001 Gunflint Lowdown Blowdown. Field Tour along the Gunflint Trail. SAF North American Forest Ecology Workshop. Duluth, MN.

Seybold, S.J., R.A. Haack, D.W. Gilmore. M.A. Albers. 2003. Potential for movement of native forest insect pests within North America. Presented during the Forest Health Management Technical Session during the February 3-5, 2002. MN SAF 2003 Winter Meeting at the

Maplelage Cross-Country Ski Resort and Conference Center, Callaway, MN. Invited speaker.

Posters

2000

*Anderson, P.J., D.W. Gilmore, L.S. Yount and J.C. Zasada. 2000. Effects of blow-down and salvage/fuel reduction activity on forest succession pathways in northern Minnesota. Poster Presentation. Society of American Foresters. Washington, DC.

Gandhi, K.J.K, D.W. Gilmore and S. J. Seybold. 2000. Assessing the Impact of Wind Disturbance on Forest Insect Populations in Northern Minnesota. Rhinelander, WI.

Gandhi, K.J.K, P.J. Anderson, D.W. Gilmore, R. Haack, W. Mattson, S. J. Seybold and J.C. Zasada. 2000. Response of boreal beetles to a severe windstorm event and subsequent fuel reduction activity in northern Minnesota. Poster Presentation. Entomological Society of America. Montreal, Quebec.

2001

*Gandhi, K.J.K., Anderson, P.J., Gilmore, D.W., Haack, R.A., Mattson, W.J., Zasada, J.C., and Seybold, S.J. 2001. Responses of sub-boreal beetles to a severe windstorm event and silvicultural practices in northeastern Minnesota. Poster Presentation. North Central Forest Pest Workshop, October 1-4, 2001. Big Bay, Michigan

*Gandhi, K.J.K., Anderson, P.J., Gilmore, D.W., Katovich, S.A., Mattson, W.A., Zasada, J. C., and Seybold, S.J. 2001. Responses of sub-boreal beetles to a severe wind-disturbance event and silvicultural activities in Minnesota. Annual Meeting of the Minnesota Forestry Association, Minnesota.

*Gandhi, K.J.K., Gilmore, D.W., Katovich, S.A., Mattson, W.A., Zasada, J. C., and Seybold, S.J. 2001. Sub-boreal beetles in wind-disturbed and prescribed-burned forests. North American Forest Insect Work Conference, Edmonton, Alberta.

2002

Gandhi, K.J.K, Gilmore, D.W., Katovich, S.A., Mattson, W.J., and Seybold, S.J. 2002. Cerambycids as primary colonizers of live jack pines. Poster at the North Central Forest Pest Workshop, October 21st-24th, Potosi, Missouri.

*Gandhi, K.J.K., Gilmore, D.W., Katovich, S.A., Mattson, W.A., Zasada, J. C., and Seybold, S.J. 2002. Sub-boreal beetles in wind-disturbed and prescribed-burned forests. USDA-Forest Service Forest Health Monitoring Meeting, New Orleans.

*Gandhi, K.J.K., Gilmore, D.W., Katovich, S.A., Mattson, W.A., Zasada, J. C., and Seybold, S.J. 2002. Sub-boreal beetles in wind-disturbed and prescribed-burned forests. "Research Review: Forest Systems of the Upper Midwest", University of Minnesota, USDA Forest Service, and the Minnesota Forest Resources Council, Cloquet, Minnesota.

2003

*Gandhi, K.J.K., P.J. Anderson, D.W. Gilmore, R.A. Haack, W.J. Mattson, J.C. Zasada, and S.J. Seybold. 2003. Sub-boreal beetles in wind- disturbed and prescribed-burned forests. Joint Fire Science Program Principal Investigator Workshop, Phoenix, Arizona. March 11-13, 2003. Poster presentation.

*Gandhi, K.J.K., P.J. Anderson, D.W. Gilmore, R.A. Haack, W.J. Mattson, J.C. Zasada, and S.J. Seybold. 2003. Sub-boreal beetles in wind- disturbed and prescribed-burned forests. Great Lakes Silviculture Summit, Houghton, MI, April 22-23, 2003. Poster presentation.

*Kastendick, D.N, PJ Anderson, JC Zasada, DW Gilmore. 2003. Cumulative Effects of a Severe Wind Disturbance and Silvicultural Treatments on Forest Structure and Fuel Loadings, Superior National Forest, Northeastern Minnesota. Joint Fire Science Program Principal Investigator Workshop, Phoenix, Arizona. March 11-13, 2003. Poster presentation.

*Kastendick, D.N, PJ Anderson, JC Zasada, DW Gilmore. 2003. Cumulative Effects of a Severe Wind Disturbance and Silvicultural Treatments on Forest Structure and Fuel Loadings, Superior National Forest, Northeastern Minnesota. Great Lakes Silviculture Summit, Houghton, MI, April 22-23, 2003. Poster presentation.

2004

*Gandhi, K.J.K., D.W. Gilmore, M. Mielke, and S.J. Seybold. 2004. Use of Prescribed Fire as a Management Tool for Enhancing Pyrophilous Beetle Populations in Sub-boreal Coniferous Forests of Minnesota. Poster presentation to the USDA Forest Service Forest Health Monitoring Annual Principal Investigators Meeting. Sedona, Arizona. February 9-12, 2004